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AND THE
CARE OF THE WOUNDED ON THE
BATTLE-FIELD.

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MILITARY SURGERY AND THE CARE OF THE WOUNDED ON THE BATTLE-FIELD.

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I. NEW CONDITIONS ARISING FROM THE INTRODUCTION OF ASEPTIC SURGERY AND MODERN FIREARMS.

SINCE the close of the last great war among civilized nations a change has taken place, no less radical and complete in surgical methods than in the character and efficiency of military weapons. The old treatment of wounds and the technique of operations have been revolutionized by the discovery and general application of antiseptic principles, while in the mean time the old lead small-arm bullet, which has made the vast majority of the gunshot wounds in all modern wars, and with the effects of which military surgeons are so familiar, has been replaced by another totally different missile of great but still uncertain capabilities. The grand results which have been achieved through recent improvement in general surgery are well known. What effect the introduction of the new weapons will have upon the character of gunshot injuries and on the care and handling of the wounded is not yet fully determined. The experience and the literature accumulated during former wars are based almost wholly upon the results of the old surgery with the old weapons now obsolete.

The effects of the new infantry rifle projectile on animate and inanimate objects have recently been the subject of most elaborate study by surgeons in this country and abroad. Experiments on the cadaver show the mechanical action of the new projectile on dead and more or less deteriorated animal structures, as well as the effect of these structures on the stability of the bullet; but there are many important questions of the utmost interest to the military surgeon upon which they can give no evidence. The tearing and mangling produced upon decayed muscles and putrid viscera can hardly be the same as upon those organs in the living state. The flaccid and inelastic condition of dead skin must certainly have an influence on the size and appearance of wound-openings. Experiments on the cadaver furnish no evidence as to the percentage of mortality, immediate or remote, in any class of injuries, nor as to those important factors in gunshot wounds, shock and hemorrhage, nor of the results of treatment, the occurrence of suppuration or of septicæmia.

It is evident from present indications that the small-calibre bullet, which must eventually be adopted among all nations, will be one which is practically indeformable against animal structures and almost

identical in ballistic qualities—alike in form, weight, calibre, and velocity, and alike for the rifle, the carbine, and the machine-gun. The factors which enter into the causation of gunshot wounds from these missiles will thus be so constant and uniform as to produce far more constant and uniform results than have been observed with the old deforming lead bullet. The difference between these two, as stated by Delorme and Chavasse, lies mainly in the greater force of penetration, greater stability, and smaller diameter of the former. There can be no doubt that the new bullet will exert a more definite effect on the tissues than did the old, whether more fatal in the long run or less. There will be fewer doubtful cases. The great difficulty in determining the prognosis of gunshot wounds made by the old bullet was the uncertainty as to what complications might exist. Even when the wounds of entrance and exit were clearly marked, there could be no assurance that a part of the lead, or pieces of the clothing or other foreign matter were not left concealed in the tissues. That the small-calibre bullet rarely remains in the body when fired from any distance within the effective range of the rifle, that it rarely deforms even on impact against resisting bone, and rarely carries clothing or infectious material into the wound, are new features of the greatest importance to the surgeon and the patient.

As the modern rifle projectile has a greater velocity, a flatter trajectory, and consequently a wider range within the ordinary height of a soldier than the old, and as it is capable of penetrating the human body, or even five bodies in a direct line, without regard to the structures intervening, as shown in the experiments of Bruns and others, and as a greater number of the small cartridges can be carried in the belt and fired with greater accuracy and rapidity than formerly, it may be assumed that there will be a greater number of men wounded on the battle-field within a given time in future wars than have been in the past. Tactical changes must be made to meet the new conditions. Lines of battle will no doubt be greatly extended, distances on the field will be vastly increased, and the wounded will in consequence become widely scattered. Engagements will open at longer ranges, and, with the use of relatively smokeless powders, they will proceed with greater accuracy of aim and more destructive effect. Battles will be shorter, sharper, and more decisive, and campaigns with all their disastrous consequences of sickness from camp and epidemic diseases will be less prolonged.

The ratio of killed to wounded appears likely with the new weapons to be increased. The long, clean cut, non-contused tracks of the small-calibre bullet favor internal hemorrhage, one chief cause of mortality in the field. But, on the other hand, for those who survive the immediate effects of their injuries these wounds, with their small valve-like openings that readily close, are also favorable to healing, and thus the ratio of recoveries to the number of wounded will likewise be increased, while the percentage of secondary mortality and the number of permanently crippled will be reduced, both through the more favorable character of injuries by the new projectile and through the new aseptic methods in surgery.

Much stress has been laid upon the effect which the long range of

modern firearms is expected to have upon the facilities for removing the wounded from the field. Professor von Bardeleben has recently said, in substance: "The first and most difficult task will be to remove without delay the enormous number of wounded out of the fire-line. Who will be able to tell beforehand where bandaging-places will be out of reach of the enemy's fire? Some urge an increase of sick-bearers and wagons, but this also increases the number liable to be wounded, and in order to effect an uncertain saving of one human life exposes the lives of a number of other men to danger." Battles are rarely fought on level, unobstructed plains; distances therefore between the line of battle and the dressing stations or field hospitals are not measured in yards; they are determined by the physical and topographical features, natural and artificial, of the region in rear of the battle-field. These may sometimes be very favorable, or they may be in the highest degree unfavorable, to the care and removal of the wounded. Ambulance wagons can only be brought to the front under cover of some natural object which may offer protection against artillery and infantry fire; otherwise the injured, unable to walk, must remain in sheltered places until opportunity offers for their removal. It will be quite impossible with any reasonable number of bearers to carry the usual proportion of seriously wounded from the field on litters to a point beyond the reach of modern artillery field or siege rifles, since these weapons are capable, with the new powders, of exploding shells with considerable accuracy against visible objects at a distance of from three to five miles. This seems to indicate the necessity for plenty of surgeons and attendants at the various collecting stations or nearest places of safety where the wounded may be held and cared for during the prevalence of the "traumatic epidemic" of battle, and perhaps for some time after. It has been suggested by eminent authority that under the new conditions, plans for the immediate removal of the wounded from the field should be given up and efforts made to provide temporary hospital accommodation for them in such places as may be practicable near at hand.

II. FIELD ORGANIZATION.

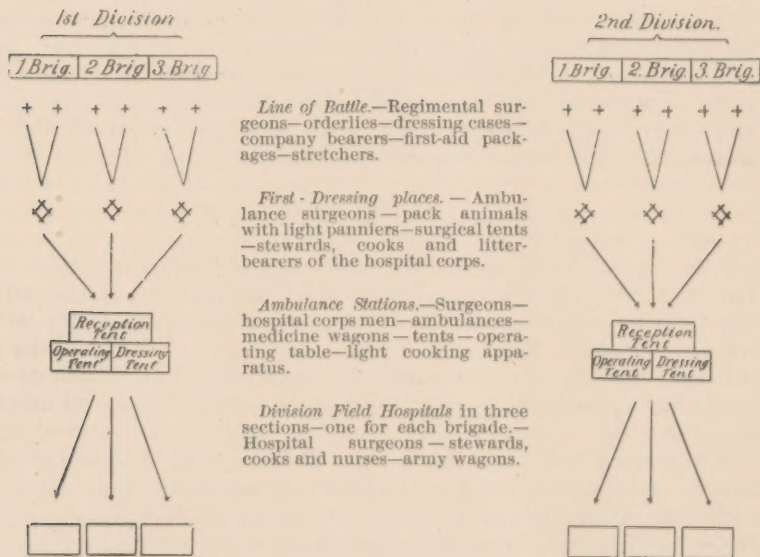
A well-organized system for rendering prompt aid to the wounded on the field now forms part of the military establishment of every civilized nation. These systems are identical in principle and differ only in matters of minor detail. The original prototype of all is to be found in the "ambulance volante" of Baron Larrey, which Napoleon said was "the happiest conception of the age," and in the brancardiers of Baron Percy.

The organization maintained in time of peace is so constructed as to be capable of expansion and readjustment to meet the necessities of war. The medical officers, who have been stationed at the barracks and hospitals or elsewhere, are, on mobilization of the army, assigned to the different administrative and executive duties with the corps, divisions, and regiments, or to the division hospitals and ambulance companies, for the campaign. The hospital corps, which has been thoroughly instructed and drilled in the use of the litters and ambulances, in the handling of the wounded, and in the care and feeding and nursing of the sick, is now

organized into two separate and distinct detachments—one for duty with the field hospitals and the other to man the ambulances and litters for the collection and removal of the wounded from the field.

United States Army.—The materials for a very comprehensive and efficient field service are at hand in the United States army, and the general plan of the work is outlined, but many of the practical details are left to be arranged when the necessity shall arise. The regulations provide that in time of war “the privates of the corps to perform the duties of litter-bearers, service with the ambulances, and at dressing and ambulance stations should number at least 2 per cent. of the aggregate strength of the command,” and that “to every ten privates there should be an acting hospital steward, and to every thirty privates a hospital steward.” As an auxiliary to this corps it is further provided that “there shall be in each company four privates designated for instruction as litter-bearers.” They retain their status as combatants, being selected merely to “give first aid to the wounded or to carry them to the rear until relieved by the members of the hospital corps,” after which they resume their arms and their places with the troops. The ambulance and hospital services of each corps are under the supervision of its medical director. The wounded are to receive attention—first, on the line of battle; second, at the first-dressing places; third, at the ambulance stations; and fourth, at the division hospitals. The first-dressing places are to be established at the nearest point to the combatants where the wounded and those caring for them may not be unnecessarily exposed to

FIG. 252.



Schematic diagram showing theoretical arrangement of the several lines of medical aid on the field.

fire. Ambulance stations will be established at some place of security in rear or in some convenient building near the field. The division hospital will be located by the medical director after consultation with the

commanding general. Two-horse ambulance wagons, "equipped with such number of stretchers and other appliances as may be prescribed by the surgeon-general," are provided on the basis of three to each infantry regiment of five hundred men or more, two to each cavalry regiment of like strength, and one to each battery of artillery; two such ambulances to the headquarters of each corps, and to each division train of ambulances two army wagons. Corps ambulance medicine wagons are contemplated, but their number, contents, and distribution are left for future determination. The ambulance wagons of the corps are organized by authority of the medical director into trains for the different divisions and brigades, and a suitable number of officers of the line are to be detailed to take charge and handle them on the field as may be required by the medical officers in the collection and removal of the wounded. The privates of the hospital corps in the field in time of war will be organized into a company for each brigade, with their hospital stewards and acting hospital stewards, under the command of a medical officer. They camp near the division, brigade, or field hospital with the ambulance train, to be in readiness for service when needed.

English Army.—As at present laid down in British regulations, an army corps numbering 37,431 of all ranks has with it 105 medical officers all told, and 798 non-commissioned officers and men of the "medical staff corps." With a fighting strength of 35,000 men this gives 1 medical officer to 333 combatants. There is one bearer company and one field hospital to each of the six brigades.

A *bearer company* has 3 medical officers and 64 non-commissioned officers and privates of the medical staff corps, 1 officer and 36 enlisted men of the "army service corps," with 10 two-horse ambulances, 2 carts, and 2 wagons.

The *field hospitals* have 100 beds each, with 4 medical officers and the usual personnel and transport.

In *action* the bearer companies are formed into two sections, under 1 medical officer, of 1 sergeant and 16 privates each; 5 corporals and 3 privates, in addition to the drivers, serve with the ambulances; 1 sergeant is placed at each brigade "collecting station," and 2 medical officers, 4 non-commissioned officers, 1 bugler, and 3 privates, including a cook and a tent for surgical operations, at each "dressing station." The ambulance wagons are likewise divided into two sections, one of which plies between the collecting and the dressing stations, and the other between the latter and the field hospitals. Each battalion of infantry and regiment of cavalry is provided with a medicine cart, which carries to the field the stretchers for the company bearers. A corporal orderly remains with each cart and the two panniers and circular surgical tent, while the private orderly takes from the cart his field companion and surgical haversack with the two water-bottles, and at the same time the company bearers fall out, place their kits on the cart, take the stretchers, and report to the battalion or regimental surgeon.

European Armies.—The sanitary organizations of European armies are all constructed on the same principles and are very similar. A German army corps of twenty-four battalions of infantry 1000 strong has three "sanitary detachments" and two in reserve, with 1 captain and 2 lieutenants of the line, 7 medical officers, 3 petty officers, 159 stretcher-

bearers, 48 non-commissioned officers and privates of the "sanitary corps," and 31 "train-men" to each; also 8 ambulance, 2 medicine, and 2 baggage wagons, all two-horse, and 56 stretchers on the ambulance wagons. There are 12 field hospitals to a corps and 6 in reserve, of 200 beds each, with 1 surgeon in chief, 1 staff surgeon and 3 assistants, and 21 attendants. Two medical officers are supposed to be with each battalion of infantry and regiment of calvary, and one with each battery in the field. The orderly knapsacks are brought to the front on the pharmacy wagons, and are carried on the field, with infantry and cavalry alike dismounted. In the Danish, Belgian, and Russians armies orderlies carry the medical knapsacks also on the march.

In the Austro-Hungarian army each infantry division of 18,000 men has a "sanitary detachment" of 2 line officers and 95 men combatants organized to form two first-aid stations, one dressing station, one "ambulance" and one "sanitary material reserve," also supplemented by a sanitary column of the German order of Knights. The "ambulance" has 3 surgeons permanently attached; the other dressing-places are supplied during battle by the regimental surgeons. Field hospitals are organized one for every division of infantry, but they are not attached to the divisions. They remain independent, to be assigned wherever required. Every non-commissioned officer and soldier carries a small dressing package covered with sheet metal, containing 2 pieces sublimate gauze, 2 pieces oiled silk, 10 grammes cotton, 2 safety-pins, and a triangular handkerchief or 4 metres of bandage. Each stretcher-bearer carries a leather pouch on his waist-belt containing 10 dressing packets, 1 tourniquet, some cotton, a small cup, 2 triangular bandages, 5 safety-pins, and a pocket-knife; also 2 water-bottles. The "bandage-bearers" carry in action medical or surgical knapsacks brought to the field in the wagons, containing medicines, dressings, and surgical instruments. Each surgeon with the troops carries a leather pouch with two pockets containing some medicines and a small case of instruments.

The details of sanitary organization in European armies are important as examples for comparison and study, because they have in very recent years undergone thorough revision and improvement, the result of experience in war and to meet the new conditions presented by the introduction of modern firearms. Germany has been the leading power in these advancements, and other nations have closely watched and copied her methods, by which the various systems formerly in vogue have become more uniform in construction and more practically useful in operation.

III. PREPARATIONS FOR THE FIELD.

The principal things to be considered in preparing for the field in time of peace are the training of the hospital-corps men and the company bearers; the selection and arranging of the most suitable instruments, medicines, and dressings in convenient form for use at the different points along the lines of medical aid; the preparation of tents, bedding, cooking utensils, furniture, and appliances for the field hospitals; and the organization of efficient means of transportation. All these important matters have received close attention of late years from the medical

departments of foreign armies, but, although great advancement toward perfection has been made, there is still room for improvement in many practical points.

The *hospital corps*, especially the more intelligent members—stewards and acting hospital stewards—should receive, among other things, very careful and thorough instruction in the principles of antiseptic surgical methods, and they should be so trained as to make them reliable assistants in time of operations. In military surgical practice on the field, whether at the dressing stations or at the hospitals, it will rarely happen that more than one or two medical officers are available for each operating table, and they will have to depend upon the hospital-corps men for the most essential and important assistance in many trying emergencies. The members of this corps will not all be found to possess a like aptitude for

FIG. 253.



Private, hospital corps, U. S. Army, field equipment (front view).

FIG. 254.



Private, hospital corps, U. S. Army, field equipment (rear view).

such service, but each one, while being instructed in the general duties pertaining to all, should receive some special training in the performance of those functions for which he is by nature best adapted. Some will

make better cooks than others, some better nurses; some can assist at operations, and others may only be suitable for litter-bearers or ambulance-drivers. There is reason to believe that in the vast amount of labor and pains devoted to perfecting these men in the litter drill the great advantages to be derived from special training in other branches have been overlooked. Litter-carrying is not the only function, nor the most difficult one, which the hospital corps will be called upon to exercise in the field. It will be equally important to have a few men who possess some degree of skill in the preparation of diet for the sick, in the dressing of wounds and the nursing of patients in the wards, and in the handling of instruments and dressings in the operating-rooms.

The *company bearers* perform their duties on the field under the orders of their own officers, and they should therefore be drilled and trained by their own officers. In order to ensure the presence at all times of four trained men to act as bearers and to be able to fill vacancies in case of accidents, the instructions should not be confined to any particular set of fours, but should be given alike to the entire company. The tactics as published for the bearer drill require no expert medical or surgical knowledge for their full comprehension, and the services of a medical

FIG. 255.



officer at these exercises are therefore not necessary. No instructions beyond those in bearer drill and in the various improvised means and

methods of transporting injured persons by hand will be required, as the *company bearers have no concern with the dressing of wounds*. Under present arrangements in modern armies stretchers intended for the use of company bearers are carried on the ambulance or medical wagons, which with large bodies of troops rarely reach the front in time to be of service during the early part of an engagement. Ordinarily, the company bearers will have to do most of their work as best they can without the aid of the regulation litter. Instruction, therefore, in other methods of carrying the wounded and in the construction of improvised appliances for this purpose will be of especial service to them, and it is, in fact, an essential part of their training. In the German army, in addition to the drill of the sanitary corps, a modified drill with elementary instructions in a few important methods of rendering first aid are given to all soldiers of a garrison. In the Swiss army the formation of fours as a unit for the handling of wounded on the field with the stretcher has been abandoned as unsatisfactory and impracticable, and the method of two bearers acting together has been substituted in its stead.

MATERIAL REQUIRED.—The important question as to what medical and surgical supplies will be most needed for the field must be determined from past experience and present knowledge after a careful study of all available facts bearing upon the character and relative frequency of the diseases and injuries to be treated. The accompanying Table I.,

TABLE I.

There were—	Officers.	Men.	Total.	Per cent.
Killed on the field	597	7,138	7,735	12.6
Slightly wounded	1,881	28,498	30,379	49.6
Severely wounded	1,353	21,701	23,054	37.7
Total	3,831	57,337	61,168	99.9
Remained with the troops after being wounded	688	5,972	6,660	10.9

extracted from Fischer's statistics of the killed and wounded in the Prussian army 1870-71, gives the gross results of 61,168 cases of shot injuries, from which it appears that in every 100 men hit, 12 were killed, 49 slightly and 37 severely wounded, and that 10 per cent. of

TABLE II.

Severely wounded.	Number.	Per cent.
Head and face	2,569	11.14
Throat	514	2.23
Chest	2,254	9.77
Back	793	3.44
Abdomen	1,890	8.20
Side	988	4.28
Upper extremities	5,628	24.41
Lower "	8,418	36.52
Total	23,054	99.9

the wounded remained with the command for treatment. The 23,054

severe wounds were distributed over different parts of the body, as shown in Table II. Turning to the records of the War of the Rebellion, in

TABLE III.

245,790 shot wounds, War of the Rebellion.	Number.	Per cent.
Penetrating wounds of the chest	8269	3.36
" " " abdomen	3717	1.51
Primary lesions to blood-vessels	485	0.19
" hemorrhage	110	0.04
Fractures of hip-joint	386	0.16
" of long bones, thigh	6748	2.74
" of the knee-joint	3398	1.38
" of long bones of the leg	9171	3.79
" of ankle-joint	1722	0.70
" of shoulder-joint	1579	0.64
" of long bones, arm	8245	3.31
" of elbow-joint	2816	1.15
" of long bones, forearm	5194	2.11
" of wrist-joint	1509	0.61

245,790 shot wounds the special injuries shown in Table III. were noted. These statistics are based on a large number of cases, and are therefore reliable.

Allowing for some difference in results to be obtained under the new conditions with the new armament, it is thus shown what percentage of men will be killed in battle, what proportion will be slightly or severely wounded, and the exact seat and character of all the graver injuries. Add to this about 1 per cent. for the usual accidents and from 3 to 5 per cent. for sickness, and there is all the information necessary under ordinary circumstances to guide in the selection of medicines, instruments, dressings, or other material and transportation to be taken to the field. The necessity for some means of immobilizing broken bones will be at once apparent. From two to three compound fractures of the thigh, three to four of the leg, three to four of the arm, two to three of the forearm, and one or more each of the knee- and elbow-joint may be expected among every hundred of the wounded.

Splints of light wire, which may be carried in the roll or in pieces of suitable size, are very convenient, especially for first dressings. The French surgeons speak favorably of this material. The coil given to it in the roll imparts additional strength in the longitudinal direction. *Plaster splints* are of great service in the field, but formal dressings of this kind consume time and require some skill and assistance in their application, and there is the additional disadvantage that they are difficult to utilize in damp or rainy weather. Instead of using the heavy plaster dressing alone, it is better to combine it with some other lighter material as a basis. Wire splints may be cut from the roll, and after being adjusted with proper padding beneath they may be secured by a couple of plaster rollers, or some other light splint material, or even extemporized splints out of reeds, brush, or twigs may be used in the same way. *Thin wooden splints* are very practical and easily carried. A number of these may be brought along in the mule panniers, and when applied under plaster rollers they make very firm support. Like the combination of wire and plaster, they are lighter and quicker to dry, and more

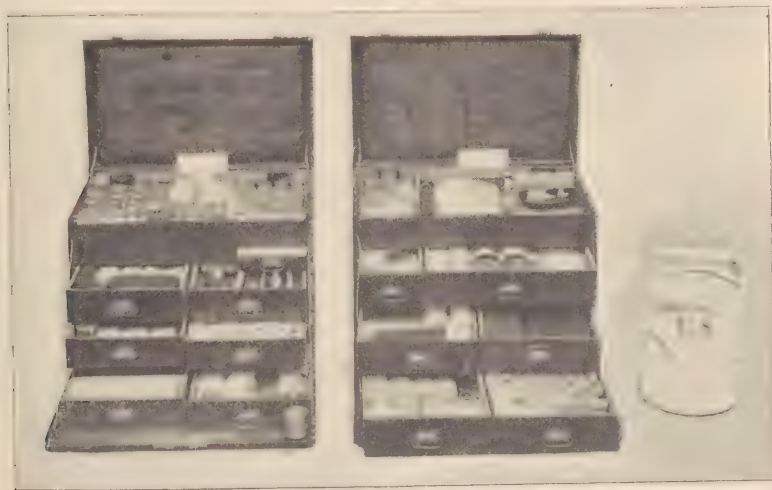
readily applied and much more easily removed, than the ordinary plaster splints for temporarily fixing broken limbs. Telegraph wire with the aid of a file or a file-backed knife has also been used for this purpose.

Extemporized splints are not to be relied upon too much in the field, for although there may be occasions and places where the materials for their preparation are at hand, this will often be found difficult or impracticable on account of the time and inconvenience involved in procuring them. When on an active campaign the troops happen to be in the vicinity of swamps or thickets where reeds, rushes, tall sedges, or the thin, straight shoots of such shrubs as the red osier dogwood or the euonymus or willow abound, the opportunity may be improved by having a few splints prepared to supplement the limited supply on hand. Guns, ramrods, and bayonets constitute the least desirable material for this purpose, and they are not always available, although a rifle may sometimes be utilized as the long splint on one side of a fractured lower extremity.

The application of splints requires a considerable quantity of other material for padding and bandaging, principally jute, cotton, gauze, and adhesive plaster. The latter may often be used on the outside to secure dressings in place with economy of time and material. All these articles should be in readiness for use in convenient parcels compressed into as small a bulk as possible—bandages cut and rolled, adhesive plaster on spools, and cotton and gauze in small cartoons. Expense cannot be considered in the preparations for war until after all other requirements have been satisfied.

Antiseptic and Aseptic Materials.—Medicines, instruments, and dressings must be selected to conform to the latest advancement in medical

FIG. 256.

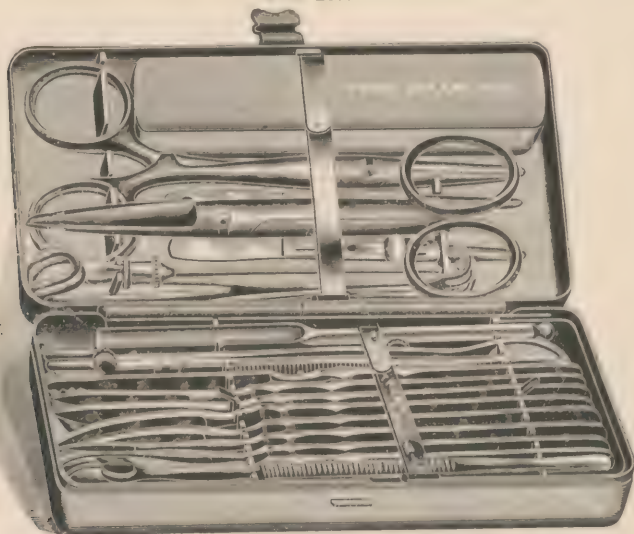


U. S. army regulation panniers, 1894.

and surgical practice. The demands of antiseptic principles are to be met in military surgery on the field as far as possible, limited only by the necessities and exigencies of warfare. The antiseptic agent most

extensively employed in the present status of surgical technique is heat. Fire and a limited amount of water can usually be secured on the field, and they can always be supplemented by such chemical antiseptics as the bichloride of mercury, carbolic acid, kresol, and others. Tablets composed of about 7.5 grains each of corrosive sublimate and the chloride of sodium or ammonium are very convenient for field use. One tablet to a pint of water makes a 1 : 1000 solution. Pure carbolic acid in crystals may be carried in small strong bottles, and, for convenience of measuring, it may be reduced to a liquid by the addition of a few drops of water when wanted. Trikresol, which appears to be a very valuable surgical antiseptic, or formalin occupies very little space.

FIG. 257.



Senn's emergency pocket operating-case.

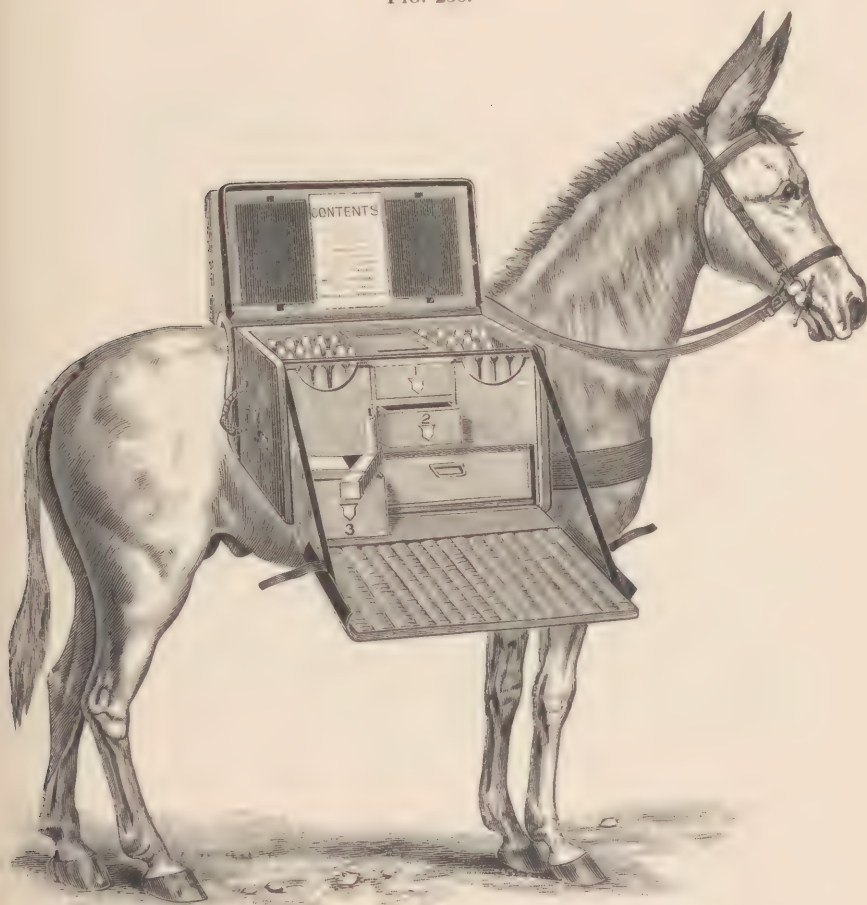
Catgut ligature for the field should be wound on small glass spools, and, after being sterilized by boiling in absolute alcohol, may be kept in bottles of absolute alcohol secured by rubber stoppers and caps. When the ligature is to be used, the cap and stopper are removed and one of the spools lifted out with forceps and placed in the operator's hand or in alcohol, or the thread may be drawn up from the bottle and cut as required, but it is never to be drawn through a hole in the stopper. The smallest bottle of catgut ligature for convenience at the front might be about an inch square by an inch and a half high, which will contain 3 yards of fine, $2\frac{1}{2}$ yards of medium, and 1 yard of coarse ligature on three glass spools. *Silkworm gut* may be carried dry, and sterilized by boiling with the instruments or otherwise, or by immersion in a 1 : 1000 bichloride solution as wanted. *Silk* ligature is best carried in the needle threaded and sewed into pieces of linen or cotton stuff in lots of from one to three or four dozen. These may be sterilized by boiling for a few minutes with the instruments. Bichloride gauze may be carried in small sealed packages with safety, but carbolated and

salicylated dressings are not reliable except when freshly prepared, nor are they in the least necessary in the field.

IV. DISTRIBUTION OF MATERIAL ALONG THE LINES OF MEDICAL AID.

On the Line of Battle.—It is obvious that medical and surgical materials and appliances for field service must be especially selected and adapted to meet the needs of each particular point along the lines of medical aid for which they are designed. The dressing-case or pouch carried by the regimental surgeon's orderly is for use with troops away from all other sources of supply, and it should be equipped and kept

FIG. 258.



Medical pannier mounted.

for that purpose only. Sick and wounded men will be left behind when the troops advance, and there will be no demands upon its contents except for the treatment of such acute cases of illness or injury

as may happen on the march or in action. As the surgeon is obliged to remain with his regiment, he will have few opportunities for the performance of operations or to attend to sick or wounded men unable to keep up with the command. These conditions indicate at once what articles are to be supplied to the regimental surgeon and his mounted orderly. A few simple medicines for the relief of pain, shock, fainting, nausea, diarrhoea, heat, exhaustion, and the like; a pocket case of instruments for small operations; antiseptic tablets, carbolic acid, cocaine, chloroform, and bottle for anaesthesia; catgut, silk, and silkworm-gut ligature; wire or wooden veneer splints; plaster rollers wrapped and sealed separately in paper; compressed gauze, jute, gauze bandages, a spool of adhesive plaster, and a 2½-inch rubber bandage. By properly

FIG. 259.



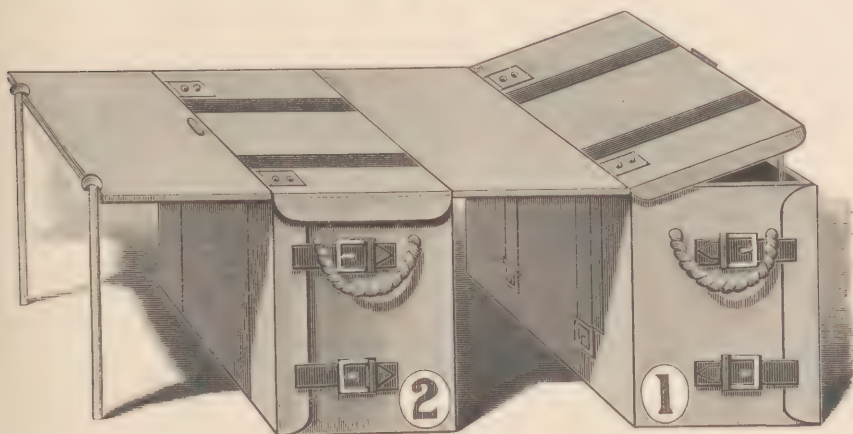
Surgical pannier dismounted.

regulating the proportionate amount of these articles, and with the frequent opportunities to renew what has been used, all of them can be carried and made available.

At the first-dressing places the articles needed include all those above named, but in much larger quantity, and with the addition of a case or two of well-selected and compactly arranged instruments for general operations, including the elevation of depressed fracture of the skull, tracheotomy, amputations, and the ligature of arteries; an operating

tent, a cook, and some sort of small portable cooking apparatus and condensed liquid nourishment. In many European armies the little first-dressing packages carried by the soldiers constitute the only aid provided for sick or wounded at the front until the medicine carts come up and bring the orderlies with their knapsacks, haversacks, and water-bottles and the stretchers for the company bearers. In our service the surgeon's orderlies are mounted and carry the pouches with them on the march, but there is nothing provided for the first-dressing places until the arrival of the panniers, which are carried on the ambulances; and this may not, and usually does not, occur until long after the engagement is in progress and the field is strewn with the wounded. Wheeled transportation cannot be depended upon to reach the scene of conflict until some hours after a considerable number of men have been injured and in need of assistance. To meet this necessity the French have, instead of the battalion medicine carts, *pack-mules* carrying panniers which keep well closed up with the troops. This arrangement is greatly needed in our army, not, however, to take the place of the brigade medicine wagons which serve as a base of supplies for distribution to other points, but in addition and auxiliary to them. At least one pack-mule with two light panniers should be provided to each brigade to supply material for the first-dressing places in the interval between the commencement of hostilities and the arrival of

FIG. 260.



Panniers as an operating table.

the hospital-corps men with the ambulance train. The surgical tent and at least two or three even of our present heavy stretchers might also be brought up on the mule. A light form of stretcher, with perhaps bamboo poles or one that folds and has a joint of separation transversely, is much needed for this particular purpose. The panniers serve for an operating table. The cook may be mounted and utilized to bring up the mule. Scarcity of water is often a serious difficulty at these places, but the surgeons may sometimes be able to locate them on the borders of a stream or near a well or spring.

Ambulance Stations.—The equipment of an ambulance station comprises some tents, which when practicable are pitched in connection with such local buildings or shelter as may be found available; a light field cook-stove and commissary stores; stimulants; concentrated food for the preparation of hot coffee, soup, and other nourishment; and the brigade medicine wagons supplied with instruments and appliances necessary for permanent or emergency dressings, and for such operations as circumstances require or as time and opportunity may permit. These stations should be so organized as to supply their own transportation in the ambulances entirely independent of the army wagons, in order that they may get to the field and into operation as early as possible after the trouble begins, and without waiting for the heavily-laden trains, which must necessarily be delayed. The value of medical aid on the field is often dependent upon the promptness with which it is rendered. The fate of many cases is determined by the earlier or later arrival of these light, quick-moving vehicles with needful assistance. Ambulance stations, like the division hospitals, are always to be located where there is a good supply of water, fuel, and, when practicable, hay or straw. There should be at least three medical officers and a sufficient number of hospital-corps men. The wounded are often obliged to remain at the ambulance stations during the first night and sometimes longer after a battle, and in case of victory the field hospitals may be located there, or when defeat is sustained the disabled may be collected and left there with a medical officer under the supposed protection of the Geneva articles of agreement.

Field Hospitals.—In our army a field hospital is organized to meet the requirements of each division, but it may be separated into its integral parts and distributed to the brigades or regiments when they are operating as independent commands. It is transported on army wagons. The tents, furniture, and most of the appliances appear by comparison to possess qualities which in point of practical utility are fully up to if not ahead of those of any foreign power. The light folding cots, chairs, and tables are especially noted for excellence and suitability to their purpose. The most desirable location for a field hospital during hot or even moderately cool weather is in the vicinity of large barns with adjoining sheds, which can be thrown open so as to furnish shelter overhead and a free circulation of air throughout. Around this the tents may be pitched, and with the sides raised conditions are obtained which admit practically of an out-door treatment for the wounded, under which, notwithstanding many apparent discomforts, they do far better than in close quarters.

It is a matter of the utmost importance that the field hospitals, when they are to be established at all, should be got into operation in time to receive the wounded soon after they are injured, and before many have perished or suffered serious impairment of the chances of recovery for want of aid which can only be supplied at some permanent place of rest. The *Surgical History of the War of the Rebellion* records many cases of gunshot fractures and other injuries to soldiers who received the first serious attention only after journeying over long distances, during several days, from the field, sometimes to the general hospitals. Forwarded from place to place for one reason or another, and jolted

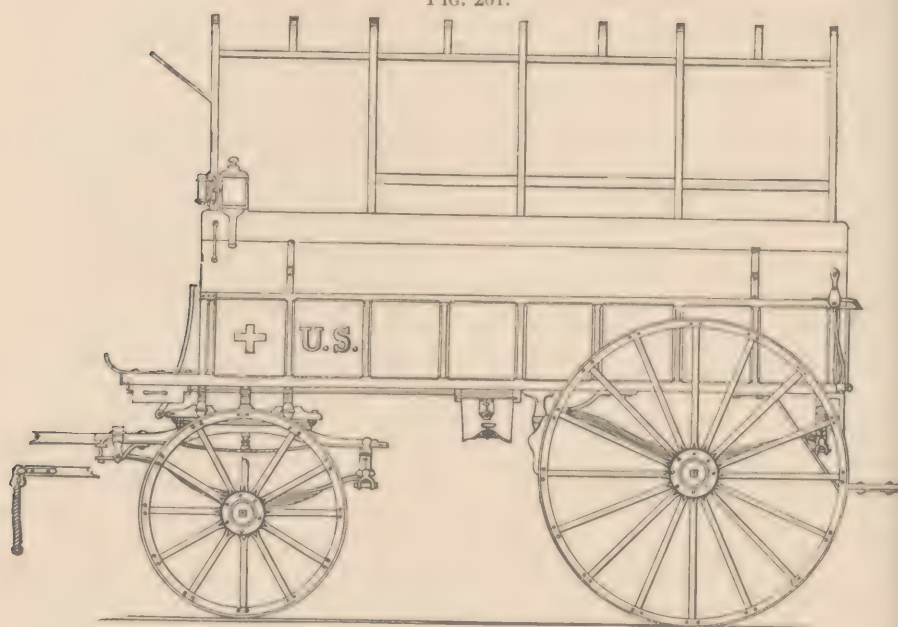
about until their wounds began to suppurate, the treatment which came at last was often too late to save them, and was only followed by the addition of another specimen to the Army Medical Museum, where the ghastly evidence of numerous instances of this kind may be found. It is rarely possible to hurry up the heavy wagons, but the medical staff detailed for hospital duty should come on the field with the troops, and as soon as the engagement becomes settled, or even earlier, they can usually select a site for the field hospital, and with a little assistance begin work at a place where the wounded may be sent, and where they may remain at rest for some time after operations and dressings. In order to carry this plan into effect, it will only be necessary to organize an *advance* or *flying detachment of the field hospital*, consisting of a medicine wagon and one or two light ambulance transport wagons carrying about three tents and three operating tables, with such instruments, dressings, and appliances as will enable the three operating surgeons, their assistants, and a few non-commissioned officers and nurses to begin and carry on their labors while the heavier wagons and material of the train are coming up.

V. TRANSPORTATION.

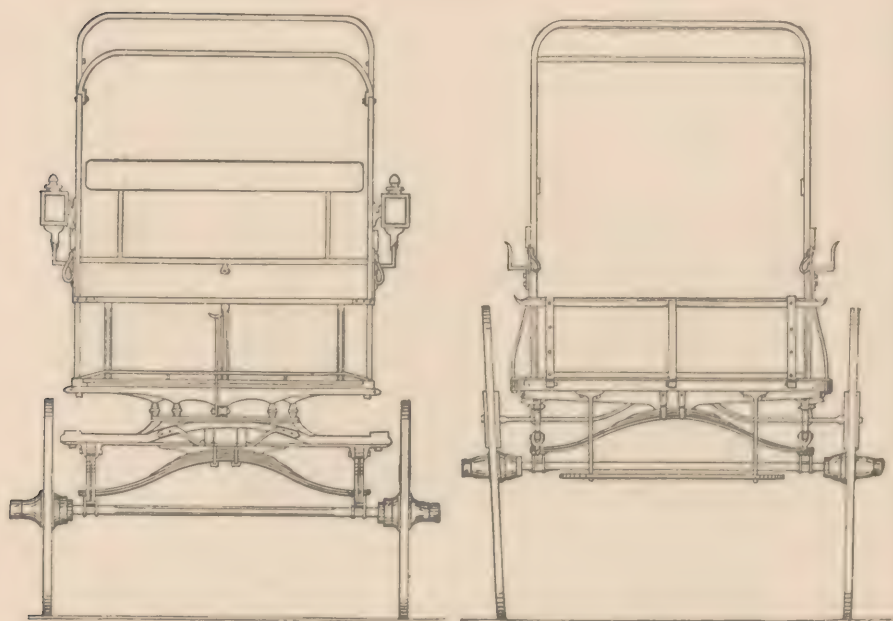
The enormous trains of ammunition, provision, and baggage wagons, artillery, ambulances, horses, and mules, that accumulate in the rear of an army form encumbrances to its movements which should be understood and appreciated by those who are preparing supplies to take the field. In 1862, when McClellan's army of about 100,000 men moved back from the Chickahominy to the James River, there were 4000 wagons, 500 ambulances, 350 field-pieces, 50 siege-guns, 40,000 horses and mules, and 2500 head of beef-cattle in its train, "following a single road, a mere woodland path, constantly occupied by troops on the march or obstructed by infantry or cavalry, amid the din of battle, which was heard simultaneously in front and rear and on the flanks."¹ The one object of solicitude was this train, which was kept together in front and closely guarded. No part of it was available for the benefit of sick or wounded except a few light flying ambulances, and many of the more severely injured in all the battles had to be left on the field. The longer the marches undertaken, the farther from railroads and bases of supply, the greater the train of an army becomes and the more difficult it is to handle and protect. The narrow country roads winding through forest and thicket and over streams and hills are beset with ruts and bog-holes which increase in depth with every vehicle that passes. On a dry, sultry day men and animals are enveloped in clouds of dust; when it rains the streams are swollen until every little ditch becomes a formidable obstruction. Wheels sink into the soft ground, wagons break down or stick fast in the mud, their contents are distributed to others already overloaded, mules give out, roads become blocked, trains are delayed, and freight often has to be abandoned or destroyed. The ambulances are crowded, especially if the weather be inclement or there has been much fighting, and numerous sick and wounded straggle along by the wayside. The jolting of wagons, the braying of mules, the sharp cracking of whips,

¹ *Civil War in America*, Compte de Paris.

FIG. 261.



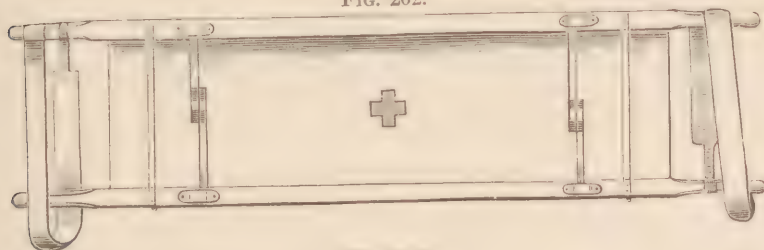
SCALE.
0 1 2 3 4 5 6 FEET.



Regulation two-horse ambulance, pattern of 1892.

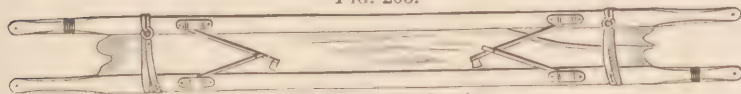
the wild shouts of the drivers characterize the scene, while the sound of distant cannon gives warning that a battle may be near at hand or in progress. The troops farthest to the front are the first to be engaged,

FIG. 262.



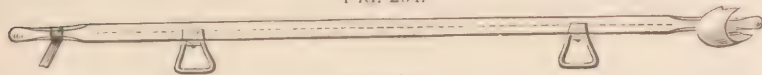
Litter open.

FIG. 263.



Litter partially closed.

FIG. 264.



Side view.

U. S. army regulation hand-litter, 1894. (New pattern under consideration.)

but in the mean time the long train, "winding its way like a huge serpent" over the road, carries with it almost everything provided for the sick and wounded, and may not reach the field until late in the night or not at all.

FIG. 265.



The Indian travois as improvised in the field.

The more severe the contest in front and the more doubtful it becomes, the more closely the train is kept together and guarded, and consequently the less available its material is at the very time when it is most wanted.

At the battle of Chancellorsville, Va., May, 1863, the trains, including the ambulances and medicine-wagons, were parked six miles from the field on the opposite bank of the Rappahannock. Later on, authority was given to take a very few ambulances only to the front. Medical supplies brought up in panniers on pack-mules constituted the chief

FIG. 266.



Dr. N. Senn's bamboo-rod stretcher.

resources of the medical department from May 1st to the 5th, when the troops recrossed the river.

At Gettysburg, on July 1st, the commanding general ordered that all trains except ammunition and ambulance wagons be sent back and parked several miles away. On the 2d, while the battle was in progress, the

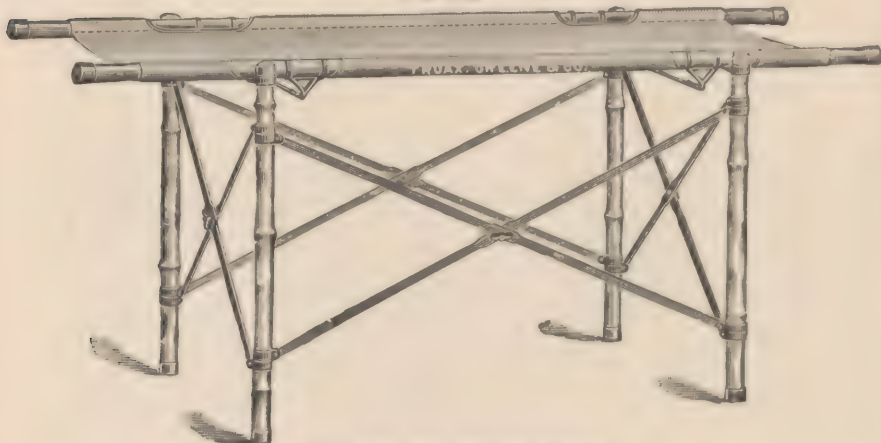
FIG. 267.



Dr. N. Senn's stretcher folded for transportation.

trains, including the hospital wagons and the especial train of medical supplies, were sent still farther back to a point about twenty-five miles from the field. In most of the corps the medicine-wagons were taken to the front with the ambulances, and thus some supplies were available for immediate use. Medical Director Letterman in his recollections of

FIG. 268.



Dr. N. Senn's field operating-table.

the Army of the Potomac says: "The want of tents, cooking apparatus, etc. occasioned by the recent orders was to me, in common with all the medical officers, a cause of the deepest regret and to the wounded of

much unnecessary suffering. Without proper means the medical department can no more take care of the wounded than the army can fight without ammunition. The medical department *had* these means, but military necessity deprived it of a portion of them, and would not permit the remainder to come upon the field. As soon as the battle terminated I requested the commanding general to allow me to order to the hospitals the wagons containing the tents, etc. and the extra supplies. After much persuasion he gave me authority to order half the number of wagons. I at once gave directions to send for them, and also for the remainder as soon as I could obtain permission to do so. These were

FIG. 269.



Dr. N. Senn's field operating-table when folded.

of much service when they arrived, but they could not reach the field in time to protect the wounded from the drenching rain which fell after the battle." The exposure of the whole field occupied by our troops to the fire of the enemy made it impossible to place the hospitals in rear of their divisions. Most of them were entirely out of the enclosure formed

FIG. 270.



Dr. N. Senn's field operating-table with top or stretcher, the latter wrapped around the folded table.

by the horseshoe-shaped line of battle. Even the temporary halting-places in the rear of the column were so unsafe that they had to be abandoned. Houses and barns, but chiefly the woods, were used as hospitals.

Transport for the sick and wounded generally is ample, and supplies are furnished in abundance, but in time of battle they are seldom to be had when most wanted. In order to get assistance to the wounded with more punctuality and more certainty, as well as more promptly, in future, less dependence must be placed upon the heavy wagons, and some material must be brought to the front on pack-mules and in advance detachments of the field hospitals.

VI. THE ARMY MEDICAL OFFICER AND HIS WORK.

The medical department of modern armies now stands about on a footing with the other staff departments. The independence of the medical corps and the supremacy of its authority in all matters affecting the health of the troops have been at length practically conceded. This concession has come about gradually as the competency of the medical officers improved and the value of their services was more and more appreciated. When they, as a class, were of little or no account, they received little or no consideration. That they now occupy a high posi-

tion in the estimation and confidence of the military authorities is the direct result of their success in organizing and extending the usefulness of the military medical service. The honors conferred upon them are due alike to their own scientific attainments and to the immense improvement in the health, morale, and efficiency which has been wrought among the troops of all nations through their efforts.

In Camp and on the March.—The surgeon is the sanitary officer of his command. Under modern army administration his advice is sought and given in all matters that relate to the physical or mental character of the men, to the location of camps and garrisons, the construction of buildings, ventilation, heating and lighting, quality of food and clothing, cleanliness, and general police and sanitation. The army medical officers have entire charge of the care, feeding, nursing, treatment, and transportation of the sick and wounded. It is their task not only to provide for the wounded on the battle-field, where hundreds and sometimes thousands of men are shot down within a few minutes, but to meet and keep back the enemy in the rear—to protect the troops against attacks of scurvy, diarrhoea, dysentery, and malaria, the invasion of cholera, yellow fever, and typhus, and to ward off numerous other more or less serious troubles which carry on a perpetual skirmishing about every military camp.

In times of peace, in the quietude of garrison life, with comfortable quarters, good food, regular exercise, strict discipline, and proper sanitary surroundings, it is no more difficult to maintain a state of health among soldiers than among citizens of the same locality. The constant care and training to which they are subjected under the supervision of experienced officers; the habits of cleanliness, obedience to orders, and methodical rules; the inspiration of military pride, martial music, and warlike display; wholesome recreation and congenial companionship,—all have an elevating influence on the manhood of a soldier and tend to promote his moral and physical health. But in the field and in camp the conditions are different. Sudden changes in the mode of living, in the kind and quality of food, means of cooking, irregular meals, exposure to the weather, nervous excitement, loss of sleep, defeat and depressing influences, invite and are soon followed by disease in some form, especially among the unseasoned recruits. Macleod says: "It is not the numbers who fall in action that constitute the greatest loss; they are but a small proportion to those who in the course of every campaign sink under neglected wounds, want, fatigue, and disease."

The rapid progress made during recent years in sanitary science and preventive medicine has caused the true value and importance of army hygiene to be appreciated by all classes of military men. Through the advancements in pathology and bacteriology some of the diseases and injuries which most interest the army surgeon are now better understood, and therefore better methods of prevention and treatment have become available. Medical officers everywhere have been prompt to take advantage of this knowledge, and to make practical application of it for the benefit of troops in the field. The favorable results of these measures are shown in the medical and surgical records of recent wars, and of our own campaigns on the frontier, as compared with those of former times.

Sick and wounded, unable to keep up with their commands on the march, are carried on the ambulance train, and those injured or taken ill

during the day are allowed to fall back to it, where at least one medical officer to each brigade is present to receive them and to render such aid as may be practicable until the camping-place is reached, when they are usually quartered with their companies, but, when necessary, the regimental or a part of the brigade or division hospital may be temporarily organized for their benefit. There is usually a morning sick-call, at which the cases requiring ambulance assistance are selected and designated for the march. But the experienced surgeon will soon find that it is much wiser to simply make an informal inspection of such cases as may be presented, extending his aid to the modest and the ambitious, instead of offering a general invitation to men to give up for slight ailments and overcrowd the ambulance train early in the day. One of the most difficult and disagreeable duties of the regimental surgeon is to ride in the rear of the command on a long fatiguing march and keep up the stragglers, deciding promptly and resolutely who *can* continue his exertions and who *must* be allowed to fall out.

On the Battle-field.—Surgery learned in the colleges and witnessed at the hospitals and in the well-appointed and thoroughly equipped operating-rooms, though the same in principle, is quite different in practice from that which is presented at the theatre of war. The conditions and circumstances under which the military surgeons have to perform their work, the peculiar class of injuries to be treated, and the necessarily limited resources available for the purpose are its distinguishing features. The ligation of an artery or the amputation of a limb may be a simple matter where there is ample time and plenty of competent assistants, and where all the necessary means and appliances are at hand to add to the convenience and success of the operation; but when this has to be done on the field with hastily-prepared and deficient arrangements, with inadequate help or none, in the midst of confusion and hurry, and the clamor of wounded men suffering on all sides from want of attention—in the night, most likely, with only the flickering light of a candle or two for illumination—in the rain and mud, with cold hands and benumbed fingers, tired and exhausted from overwork, it is quite another thing.

On the night after a battle the surgeons find no time for rest. They must take advantage of the opportunities offered by darkness and the cessation of hostilities to gather in the wounded and attend to them. These are often widely scattered, and must be sought after in woods, thickets, and fields, and collected together under many difficulties. For two or three consecutive days and nights the demands upon the strength and endurance of the surgeons from these exhausting labors may be almost continuous. The sultry heat and dust of the day are not unfrequently followed by a drenching rain with its unpleasant accompaniments of wet clothes and deep mud. The wounded will be found lying in ravines and on rocky hillsides where the access of ambulance wagons is difficult, or they may be out on the open plain exposed to the enemy's fire, where the least appearance of a light is sufficient to attract a shower of bullets.

On the first line of assistance one medical officer for each regiment remains with his command during the action to give aid and comfort to the wounded and to superintend their collection and removal by the company bearers. Lines of battle sway back and forth or swing round,

and men may fall and lie for hours or days between the two contending forces. Skirmishers and reconnoitering parties advance from time to time in different directions, and thus the injured become separated and sometimes difficult to reach. They must be found and supplied with water and such remedies as may be suitable for the relief of pain, shock, syncope, etc., provided with a diagnosis card, and sent or carried to the rear. The application of dressings is not often practicable under such circumstances. It is of far more importance to hasten the removal of the wounded to a place of greater safety. While one wound is being dressed another may be made.

The identity of the bodies of men killed on the field is often lost. The evidence of this is to be seen in the long rows of tombstones marked "Unknown" in our national cemeteries. To avoid in future the many distressing consequences that arise from this circumstance, every soldier going into battle should be provided with a small metallic tag, and required to wear it about his neck next the skin, bearing his name, company, and regiment and the date and place of his birth.

At the collecting or first-dressing places the dangers are less and the conditions more favorable for offering the wounded some attention. There they are to be divided into three classes and designated accordingly: First, those who are able to walk to the ambulance stations or to the field hospitals; second, those who require transportation; and third, those whose condition or injuries are such that they must remain temporarily where they are. The surgery to be done at the first-dressing places will depend very largely on circumstances. If the hospitals are already established or nearly so, and the ambulance train is in position, then nothing more should be undertaken than just what is necessary to prepare the wounded for their journey to the ambulance station or to the hospital. Attention to the wounds in that case should be limited to such measures as will suffice merely to protect them against infection through the medium of dust, dirt, soiled clothing, or handling, to immobilize broken bones, and to arrest hemorrhage, until the patients can be brought to a place where better preparations have been made for taking care of them.

The fresh surface of wounds should be guarded against the touch of septic instruments or fingers on the battle-field as strenuously as they are on the operating-tables of the best-appointed hospitals. Although it appear that loose fragments of bone are present which may have to be removed from a wound, it is better to let them remain temporarily, lest by disturbing the parts some further extensive interference might become necessary for which the surgeon is not then prepared. They can do no serious harm until the wound comes to be examined under proper antiseptic precautions. Even foreign bodies, such as fragments of clothing, missiles, etc., should not be sought after beyond the surface of the wound for the same reasons.

With a few bichloride tablets, a piece of soap, and some appliance for boiling water the field surgeon can sterilize instruments, clean his hands and the region of wounds, apply dressings, and do minor operations, such as occupy but little time and require but very limited means and assistance. During heavy engagements the wounded often accumulate at the first-dressing places so rapidly that neither time nor material

can be had for elaborate dressings, but as many as practicable of the slighter injuries may be permanently dressed to relieve the labors of those at the ambulance stations and hospitals. In exposing a wound it should be remembered that clothing in the field is very limited, and sometimes very difficult to replace when destroyed. Have the thoughtfulness and consideration to open it along the seams when practicable, so that it may be laid back over the limb or body again when the wound is dressed. The surrounding parts can be quickly scrubbed with soap and water and a 1 : 1000 solution of the bichloride poured over them, washing away at the same time any particles of sand or dirt that may be on the wounded surface, but the protecting clot, if any happen to be present, should not be disturbed.

Some military surgeons then prefer to dust the wounds with iodoform and apply a dressing of dry gauze. The aseptic character of dry dressings is not so reliable in the field as in hospital, where they come direct from the sterilizer. It would be better, perhaps, not to depend too much upon so-called aseptic and antiseptic dressings for field use, but rather make arrangements to boil or otherwise sterilize them on the spot. It will usually be practicable at the first-dressing places to have hot water, to which a few corrosive-sublimate tablets or 1 per cent. of soda may be added if desirable, and to immerse the gauze in this and wring it out. The difficulties and inconveniences of carrying and handling sterile gauze—except in small quantity in sealed tin jars for some special purpose—would thus be avoided. The objections raised by many European surgeons to the first-dressing packages carried by soldiers and attendants might thus be overcome, and the materials contained in them utilized to advantage and with safety.

Dr. Jos. Bogdanik of Biala says on this point: "I would rather wounds were brought to me for treatment which had been exposed for hours to the influences of air and sunshine than those to which, with unclean hands, the sweat-covered materials of these dressing packages had been applied." It will not do to condemn these packages, for with proper precautions they may be turned to good account. Esmarch mentions a number of instances where in the German service they furnished the only material available for dressing wounds during and for some time after battles.

Dressings can only be applied by the surgeons themselves, or by the few hospital corps men who have been trained to assist at operations, and who are reliable and competent to take proper antiseptic precautions. The importance of having a number of hospital-corps men thoroughly trained to assist in this work under the supervision of the surgeons will be apparent. It is said that the fate of a wounded soldier often depends upon the first person who attends to his wounds. The unclean touch of attendants or of so-called surgeons who venture to handle a wound without being thoroughly prepared to do so is more dangerous than the original injury. Dirty fingers and probes in past wars have probably caused more deaths, more cripples, and more agony than the rifle bullet. Ignorance then was a sufficient excuse, but this can never again be pleaded in bar of trial. The one great thing which the new surgery has made possible on the battle-field is the prevention of wound-infection. Every unauthorized person—including the soldier

himself and the company bearers—should be strictly prohibited from touching the wounds under any pretext whatever, and surgeons or their authorized assistants who are found guilty of doing so without proper antiseptic precautions should be promptly punished.

Hemorrhage is often claimed as an excuse for handling wounds. Erroneous ideas seem to prevail in the popular mind as to the danger of hemorrhage after gunshot wounds, and some misleading accounts and very unsurgical recommendations have been given about it even in quite recent literature. The popular apprehension may have arisen from confounding that which is immediately and necessarily fatal on the field and that which comes on secondarily with primary hemorrhage proper among the wounded. Gunshot hemorrhage either does its fatal work at once and under circumstances where surgical aid is impracticable—often in wounds of the head, chest, or abdomen—or it is so slight as to be, usually, of little consequence until the time when secondary or delayed primary hemorrhage may sometimes be apprehended and the patient has already reached the hospital.

Parties interested in the manufacture of tourniquets might be expected to work upon the popular fears for the sale of their patented wares, but it is unfortunate that any respectable medical authority should countenance the general issue of them in opposition to the experience of so many eminent American and foreign military surgeons, who have expressed their belief that primary hemorrhage among the wounded on the battle-field, requiring the application of a tourniquet, is a very rare occurrence. Of 245,790 shot wounds during the War of Rebellion, 110 cases of primary hemorrhage are recorded, probably less than half of which were in the extremities, where a tourniquet could have been applied. Notwithstanding these facts, it has been recommended that every soldier shall provide himself with a stout piece of rubber tubing or a pair of rubber suspenders, which in case of wound in the extremities with any hemorrhage are to be wound around the limb and drawn up tight by the aid of a comrade. If the bleeding still continues (as it often will, for the constriction may be on the wrong side of the wound), one or both openings are to be plugged by thrusting a handkerchief or some such material into them with the finger. In this condition the unfortunate man passes into the hands of others, who will not dare to interfere lest the hemorrhage (which probably never was of the slightest consequence) should be renewed, until finally, after several hours, he reaches the hospital with the limb strangulated, the main vessels contused, the principal nerve-trunk paralyzed and permanently injured, and the wound infected. It is better that one man should perish quietly and painlessly on the battle-field from hemorrhage than that several men should suffer a lingering death from infected wounds in the hospitals.

When, in case of serious hemorrhage, the surgeon is not prepared to tie the vessels at both ends in the wound, the limb may be elevated and a bandage applied from the toes or fingers upward with an aseptic compress on each opening and one over the line of the main artery. Every surgeon should have at hand a good two-inch rubber bandage for use in case of operation, and when a tourniquet becomes necessary this bandage may be used, supplemented by the application of a roller bandage to the

whole limb and an aseptic compress over the wound. The portion of the rubber roller not unwound is tucked under the last turn to make pressure over the main arterial trunk, and urgent attention called to the case on the diagnosis card. When serious internal hemorrhage is going on, a quantity of blood may be saved by constricting one or more of the extremities with the rubber bandage pending operative assistance, but this, like all other applications of the tourniquet, can only be properly done by expert hands.

At the ambulance stations the surgeons are equipped to do formal operations and dressings. As much of this work as practicable is done there to relieve pressure at the hospitals, and as many as possible of the slighter injuries are permanently dressed. The wounded are received, and after careful inspection some are sent to the operating-room, some to have their wounds dressed, and others are held to await the establishment of the hospitals. In European armies the severely and the slightly wounded are separated at this point and sent to different sections of the field hospitals. Hundreds of men with slight injuries may be treated and returned to their commands without leaving the field, whereas if they once get away it is difficult to get them back again.

Among the most important questions likely to arise will be what course to pursue in certain cases of compound fractures. Now that the means of avoiding wound-infection are known, *conservative surgery* will be practised much more than was possible heretofore. Gunshot fractures of the long bones and joints may be treated conservatively when the main trunks of nerves and blood-vessels have sustained no serious injury, when the wound is aseptic, and when the soldier remains with his friends. Even though he should have to wait a day or more and be moved about before finding a place of rest where treatment may begin, if his wounds remain uninfected recovery without amputation or resection may be expected. But when the case has to be left in the hands of the enemy, where neglect and infection are certain to follow, the chances of the sufferer may be more favorable with a good primary stump permanently dressed than with a severe compound fracture which will probably result in suppuration and secondary amputation at the best.

Laparotomy for gunshot wounds of the abdominal viscera, unlike many other operations in military surgery, will always be greatly restricted in its application and usefulness by the very exacting conditions necessary to success. Wounds of the viscera do not admit of delay. There is no way to prevent sepsis, as in external wounds. The time that may elapse before an operation must be done is limited to from three to five hours, after which the chances of success diminish very rapidly. The operation must be done at the hospital in a warm, quiet room protected from wind and dust, with good light, competent assistants, plenty of time, and the advantage of the strictest antiseptic precautions. Very exceptional qualifications are demanded of the surgeon. None but those having skill and especial training in this line, and who have had considerable experience, at least on the cadaver and on living animals, should dare undertake it. The mortality from laparotomy for gunshot wounds of the intestines done by inexperienced operators will be much greater than that under the expectant plan of treatment. Except in siege operations the hospitals will rarely be established in time to offer the benefits of this operation to those

wounded in the early part of an engagement. Very few of the severely wounded will be able to reach the hospital, under ordinary circumstances, within five hours after the receipt of their injuries. Men with penetrating wounds of the abdomen suffer from shock and hemorrhage, and often have to remain for a time on the field, and they usually have to be carried long distances on litters. Such cases are brought to the hospital in the evening or during the night, when the difficulty of operation is increased by the want of proper light, or more frequently not until the following day, when it is too late. An operator with the requisite skill and experience will rarely be available, and where there are many wounded the services of two or three of the best surgeons and an hour or two of precious time can seldom be given to the doubtful benefit of one among a number of men urgently needing assistance. Battles result in defeat just as often as in victory for one side or the other, and among the wounded prisoners the benefit of laparotomy will hardly be realized, although some ante-mortem abdominal sections may be made by well-meaning surgeons with more zeal than discretion. On the whole, the outlook for future operative interference in cases of penetrating wounds of the viscera on the battle-field is not very promising. But still, there will be exceptional cases and especially favorable circumstances where this procedure may become practicable.

After every great battle all the more severely wounded ought to remain and be taken care of as near as possible to where their wounds were received. Instead of being moved from place to place and hauled about on railroad-cars and steamboats for ten days or two weeks to hospitals in the cities already crowded and infected with diseased wounds, tents and temporary hospital accommodations should be promptly brought to the wounded, and they should be left at rest and permanent treatment begun at once. They should be turned over to volunteer aid societies in order to relieve the military surgeons—who must go on with the army—and the best surgeons from civil life should come to attend them. The twenty-one thousand wounded after Gettysburg, and those from other great battles during the War of the Rebellion, included many serious cases that certainly would have done better if they had been treated in tents pitched on frames near the field, where they could have remained for a time, instead of being moved at once to the general hospitals.

